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## Meeting Record

**IMS:** 00-RU-0218

**MEETING PURPOSE:** RU/BNFL Topical Meeting to discuss TWRS-P Risk Goals and The Sellafield Reliability Data Base

**MEETING DATE/TIME:** January 25, 2000 /1:00 – 5:00 PM

**MEETING PLACE:** Walkley Room, BNFL Offices  
3000 George Washington Way  
Richland, WA

**AGENDA:**

1. RU Opening Remarks
2. BNFL discussion of Risk Goals and the Project Reliability Database

**ATTENDEES:** See Attachment 1


**PREPARED BY:** Ko Chen

**CONCURRENCE:** George Kalman

**KEY DISCUSSION ITEMS:**

The meeting began with a welcome from the RU, the introduction of attendees (Attachment 1) and a review of the meeting agenda. The RU then briefly went over the transition issues since the November topical meeting. The transition issues included the following:

- The November 1999 topical meeting was held on November 30, 1999 and the meeting minutes were issued on December 16, 1999.
- A topical meeting progress letter to describe the status of the topical meeting issues was written by the RU to BNFL on December 22, 1999.
- A preliminary BNFL topical meeting submittal was received by the RU on December 28, 1999.
- A level 1 meeting in preparation for the January 2000 topical meeting was held between the RU and BNFL on January 4, 2000 and a second level 1 meeting was held on January 6, 2000.
- The revised BNFL topical meeting submittal was received by the RU on January 11, 2000.
- The RU reviewed the submittal and forwarded comments to BNFL electronically on

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January 14, 2000. To make these comments available to the general public, they are included as attachment to the RU meeting presentation material (Attachment 4).

- A BNFL errata letter to its topical meeting submittal was received by the RU on Jan. 20, 2000.

#### Status of ISA Open Issues and Questions

Sixteen of the 133 original ISA open issues and questions remain open. The sixteen open issues and questions include:

Q. 102, Q. 31, Q. 92, A2, A3, A8, A9, A15, A18, C30, D10, D11, D12, D13, D14, D15

#### Status of Topical Meeting Action Items

As identified in the BNFL letter, dated January 11, 2000, 25 action items remain open.

#### BNFL Presentation

After this introduction by the RU, the BNFL portion of the program began.

TWRS-P risk goals were addressed during the first part of the meeting. This included an overview and discussion of the BNFL risk assessment methodology (Attachment 2). The second part of the meeting discussed BNFL's project reliability database, examples to demonstrate the BNFL risk assessment methodology, and risk goal comparison (Attachment 3).

#### Overview of BNFL Risk Goals

BNFL stated that the primary objectives of this topical meeting were to:

- Demonstrate the adequacy of the BNFL risk assessment methodology for developing a comparison to TWRS-P risk goals.
- Describe the BNFL reliability database to be used in the waste treatment plant (WTP) reliability assessment. This would include an evaluation of the Sellafield reliability database.

BNFL noted that the three applicable risk goals for WTP were defined in DOE/RL-96-0006, "Top-level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors."

The adoption of these risk goals to TWRS-P was outlined by BNFL (Attachment 2).

BNFL addressed the issue of uncertainty in the development of risk estimates for comparison to risk goals. BNFL noted that Nuclear Regulatory Commission (NRC) has addressed this issue

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(NUREG/BR-0184), by adopting the use of mean estimates for implementing the quantitative objectives. BNFL stated it will adopt a similar position. BNFL further stated its risk goals will:

- Adequately span the range of all potentially affected populations.
- Provide an adequate basis for all River Protection Project-Waste Treatment Plant (RPP-WTP) risk management activities.
- Provide specific numerical risk values for each target population.
- Serve as a benchmark for comparisons to project specific risk estimates.
- Adequately address the question of uncertainty and how it will be treated in the goal comparison process.

The RU commented that 5 mrem radiation exposure was specified by BNFL in the operation risk while no radiation exposure dosage amount was provided for both accident risk and worker accident risk. BNFL responded that 5 mrem was due to chronic exposure and accident risks do not involve chronic exposure.

#### BNFL Risk Assessment Methodology

BNFL stated it employed probabilistic risk analysis to estimate the risk for its facility. The objective of the BNFL risk assessment is to :

- Estimate how well the facility will operate within the safety envelope.
- Use the best estimate of exposure to all affected parties under all possible conditions to estimate the risk.

BNFL stated certain inputs are required to estimate the risk to a particular target population for a specified accident scenario. The information from the BNFL Cycle 1 and 2 will be used as primary inputs. The required inputs are listed in the BNFL meeting view graphs (Attachment 2). The BNFL view graphs list steps that will be used to perform the risk assessment. The view graphs also outline the expected end products of the risk assessment process as follows:

- Ranked list of DBEs with estimates of risk for each population.
- Comparisons between aggregate individual risk and each individual risk goal.

The following are exchanges between the RU and BNFL on the subject with the RU comments or questions followed by the BNFL response:

- The RU commented that the selected DBEs for risk goals estimates are shown as “unmitigated” on one of the BNFL presentation slides. This appears to be an error because all DBEs derived from the BNFL ISM Cycle 2 process come with appropriate control strategies. BNFL agreed with the comment and will correct the error.
- The accidents selected for risk goal estimates are primarily based on DBEs from the BNFL

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Cycle 2 results. Because of their potential contribution to the risk goal estimates, BNFL should also, in its risk assessment process, include accidents, which were screened out during the Cycle 2 process, due to low frequency, or low consequences.

- Some accidents may be events with low consequences but high frequencies. BNFL agreed with the comments and will include such accidents in its risk estimation.
- How will risk goals be calculated? The “best estimate” will be used in calculating the risk goal.
- Will events characterized by a given DBE be further divided for risk goal estimates? If events are different enough with respect to frequency and consequence, more DBEs will be used to characterize these events for risk goal estimates.
- Will the level of detail on event trees for risk goal estimates be similar to that in the topical meeting submittal? Will likely be less detailed in many cases.
- Will consequence and frequency estimates from the Cycle 2 process be used for the risk assessment process? They probably will be re-calculated for the risk assessment process.
- Is the risk assessment integrated with design? The risk assessment results are fed back to designers in real time. There have been several interactions already.

#### WTP Project Reliability Database

BNFL stated the Sellafield Database (SDB) was originally selected as the primary source of reliability data for its facility operations even though the SDB is proprietary, BNFL stated the SDB has many advantages because it is:

- In conveniently retrievable form with a documented heritage.
- Previously used in safety and reliability assessments for similar processes.
- Based on actual operating experience at Sellafield.

BNFL has performed a detailed review of the SDB and compared it to other existing industrial data. The review led to the following observations by BNFL:

- The SDB failure data for active components generally are in close agreement with other databases.
- The SDB failure data for passive components are less consistent with other sources.
- The SDB does not always provide demand failure rates and numerical estimates of uncertainty (error factor).

The observations above led BNFL to implement a project specific component failure rate database for the WTP project. The WTP project database is derived primarily based on data from accepted U. S. and international sources, and provides:

- Operating failure rates and sources for both active and passive components.
- Demand failure rates and sources for both active and passive components.

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- Uncertainty estimates for both operating and demand failure rates.
- Common cause failure (CCF) rate data for redundant components.
- Frequency data for the Loss of Off-site Power (LOSP) events of varying duration.
- Frequency data of Facility Blackout (FBO) for events of varying duration.
- Emergency diesel generator (EDG) failure rates.

The references used to derive WTP database are shown in Table 13 of topical meeting submittal. BNFL stated that any data taken from the SDB in the future will be qualified to ensure applicability and added to the WTP database on an “as needed” basis.

The following are the exchanges between the RU and BNFL on the subject with the RU comments or questions followed by the BNFL response:

- How much of the SDB will be used in WTP database? BNFL has not made that decision.
- How will the Sellafield data be qualified? On a “case by case” basis.
- Has BNFL looked into the reliability data of diesel engines by the Navy? The diesel engine data reported by the Navy indicates diesel engines have much higher reliability than BNFL’s experience. It could be that these engines are started from hot stand-by conditions.
- How does BNFL intend to operate its emergency diesel generators? BNFL has not yet determined whether the diesel generators will be ready for fast start, or not.
- The RU observed that WTP reliability database appeared conservative compared with other industrial sources. BNFL responded that it is really a mix. Some data are conservative while others are based on “best estimates”.

#### Worked Examples for the BNFL Risk Assessment

BNFL provided two worked examples to demonstrate its approach to assess and compare the risk to the goals. Both examples were developed to illustrate the methodology. The examples were a hydrogen venting failure and an unplanned worker exposure during pump removal. The first example was chosen based on the potential severity of the consequence and the complexity of the accident. The hydrogen venting failure was developed through the following scenario:

- Head space purge in one of the HLW Ultrafiltration Feed Vessels is lost (accident initiator).
- Radiolytic hydrogen accumulates in the vessel headspace.
- Hydrogen concentration reaches its flammability limit.
- Spark ignites hydrogen to initiate a burn or an explosion.

The second example of unplanned worker exposure during pump removal involves accidental exposure during remote removal of a HLW pretreatment pump, located in the pretreatment

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building. The example was chosen based on potentially serious consequences for workers. The results from the example can also be used to estimate aggregate risk from a class of events, which are similar in nature. BNFL noted that there are 14 similar pumps located in the pretreatment building.

An event tree analysis was used for the risk assessment. The detailed process and the results are shown on Attachment 3.

BNFL stated the two worked examples demonstrate that its proposed methodology appears both effective and practical. However, BNFL emphasized that the examples must be viewed as a demonstration only because the level of detailed information is not yet available from the ISM Cycle 2 process and the models used in the examples reflect “as probably could be” design. An outline of the example presentation is included in the attached view graph (Attachment 4).

The following are the exchanges between the RU and BNFL on the subject with the RU comments or questions followed by the BNFL response:

- The RU commented that the result of the first worked example depends on the hydrogen generation models used and BNFL has not responded to the RU review questions on that subject. BNFL responded that it is in the process of incorporating the RU review comments in its revised document of hydrogen generation and the document will be delivered to the RU very soon.
- When will BNFL complete the risk assessment work? It is expected to be completed in July of this year.
- How many people in BNFL work on the risk assessment work now? Two full-time people.
- When will the RU see the risk assessment results and in what form? The results will be delivered to the RU in the preliminary safety analysis report (PSAR). However, BNFL can provide the RU with in-progress results before that.
- BNFL indicated that the risk assessment will include both internal and external events (seismic) and the risk assessment group is working closely with the seismic group to develop the risk assessment for both internal and external accidents.
- Will the consequence of a 30% hydrogen burn be more severe than a 16% burn? Theoretically, yes.
- BNFL stated the design guide for the risk assessment methodology will be completed in next week or two.

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### **ACTION ITEMS:**

1. BNFL will provide the RU with the design guide for the risk assessment methodology when it becomes available.
2. BNFL will provide the RU with the response to the RU review comments and questions on the topical meeting submittal, which are included as Attachment 4.

### **INFORMATION EXCHANGED:**

1. The RU meeting presentation material
2. BNFL handout on compliance with risk goals
3. BNFL handout on project reliability database

### **ATTACHMENTS:**

1. The attendance list
2. BNFL handout on risk goals
3. BNFL handout on project reliability database
4. RU review comments and questions on topical meeting submittal